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30.1 CRASH TESTED BRIDGE RAILINGS

- | All bridge railings must have passed the crash tests as recommended in the NCHRP report 350 for Bridge Railings. In order to use railings other than Bridge Office Standard railing details, the railings must conform to crash tested rails which are available from the FHWA office. Any railings that are not crash tested must be reviewed by FHWA when they are used on bridge, culvert, retaining wall, etc.

- | Railings must meet the criteria for TL-3 or greater to be used on all roadways. Railings meeting TL-2 criteria may be used on roadways where the speed is 45 mph or less.

30.2 RAILING APPLICATION

The designation for railing types are shown on the Standards. Standard railing details are generally employed as follows:

- (1) The "LF" railing is preferred on state and interstate highway bridges except for some limited short span structures. The "HF" railing is used where there is high truck traffic and curved horizontal alignment creating more potential for overtopping the railing. These railings meet crash test criteria for TL-4 and TL-5 respectively.
- (2) Type "H" aluminum or steel railings are detailed on the Vertical Face Parapets "A" for sidewalks. If the structure has a sidewalk on one side only, the Sloped Face Parapet without railing is used on the side opposite the sidewalk. The Sloped Face Parapet is the recommended safety barrier adjacent to sidewalks on structures where the traffic speed is 45 mph (70 kph) or greater. Meets criteria for TL-4.
- (3) Type "F" steel railings are not allowed on the National Highway System (NHS). Type "F" railing may be used on non-NHS roadways with speeds of 45 mph or less. This railing facilitates drainage and snow removal but is usually more expensive than the Sloped Face Parapet if drains are not required at the ends of the bridge. Approach roadway beam guard railing is not required for bridges carrying less than 300 ADT. In order to meet AASHTO Specifications three or more posts are attached to the Type "F" railing. May be used when TL-2 criteria is required.
- (4) Type "M" steel railings are used on state maintained bridges where the District insists on an open railing. It is similar to the Type "F" but has a higher crash test rating. The Type "W" railing is preferred over Type "M". Meets criteria for TL-4.
- (5) Type "W" railings may be used on all functional classes of Wisconsin highway structures. Generally, Type "W" railing is considered when the highway approach requires standard beam guard and if the structure is 80 feet (25 m) or less in length. Type "W" railing is used on bridge widenings when parapet dead load is a concern. Meets criteria for TL-3.
- (6) Aesthetic railings may be used if crash tested according to Section 30.1. The Texas style parapet has been crash tested but it is very expensive. Form liners to simulate the openings would reduce the cost of this parapet. Meets criteria for TL-2.

The Standards show some combination Railings that are approved as aesthetic railings. The aesthetic additions are at least 5" from the crash-tested rail face and

do not present a snagging potential. Meets criteria for TL-2.

- (7) Approach beam guard railing is not required for box culverts carrying less than 300 ADT. If this is the case, the box culvert beam guard railing is terminated with a buffer section. Railing is not required on box culverts if there is a clear zone as defined in Facilities Design Manual 11-15-1. Non-Traversable hazards or fixed objects should not be constructed or allowed to remain within the clear zone. When this is not feasible, the use of a traffic barrier to shield the hazard or obstacle may be warranted. The barrier shall be provided only when it is cost effective as defined in Facilities Design Manual procedure 11-45-1.

When the structure approach beam guard is extended across the box culvert; refer to Standard 36.3 for details. The minimum dimension between end of box and face of guard rail provides an acceptable rail deflection to prevent a vehicle wheel from traversing over the end of the box culvert. In almost every case, the timber posts with offset blocks and standard beam guard are used. Type "W" railing may be used for maintenance and box culvert extensions to mitigate the effect of structure modifications.

- (8) The height of curbs for sidewalks is 8" (200 mm). This height should be maintained and sloped to match any approach sidewalk curb heights. This height provides for future overlays and maintains a constant cross section to meet total height requirements for pedestrians or bicycles as specified by AASHTO.
- (9) The height of any required median curb is 6" (150 mm). This will prevent normal crossovers on low speed roadways without excessive dead load.
- (10) An LF or solid parapet is preferred on all grade separation structures and railroad crossings to minimize snow removal falling on the traffic below.
- | (11) The 51" F railing may only be used on the median side, when it provides a
| continuation of the approach 51" high median barrier.

30.3 DESIGN DETAILS

Provide for expansion movement in tubular railings where expansion devices or concrete parapet deflection joints exist on the structure plan details. The tubular railing splice should be located over the joint at its midspan and made continuous with a movable internal sleeve. On conventional structures where expansion joints are likely to occur at the abutments only, if tubular railing is employed, the posts may be placed at equal increments providing that no post is nearer than 2 feet (0.6 m) from deflection joints in the parapet at the piers.

Epoxy coated bars are required for all concrete parapets, curbs, medians, and sidewalks. Refer to Standard 30.7 for detailing concrete parapet or median deflection joints due to previous experience with transverse deck cracking beneath the parapet joints.

Horizontal cracking occurred near the top of some vertical type "C" parapets which were slip formed. Similar cracking has not occurred on parapets cast in forms. Therefore, slip forming of bridge parapets should not be allowed.

Detail erection joints at the one-sixth panel point for Type "F" railing. This location will insure primarily a shear transfer at the railing splices. For beam guard type railing, locate the expansion splice at a post or on either side of the expansion joint.

On skewed bridges where the length from the rail post to the first guard rail posts exceeds 3 feet (1 m), employ the following detail: Extend the railing to the backface of the abutment. Bolt a plate to the back of the rails right before the rail bend. In case of vehicle impact, this detail will cause the rails to act as a unit in preventing vehicle wheel snagging.

Note the AASHTO Specification for a maximum opening of 6" (150 mm) on lower rail elements.

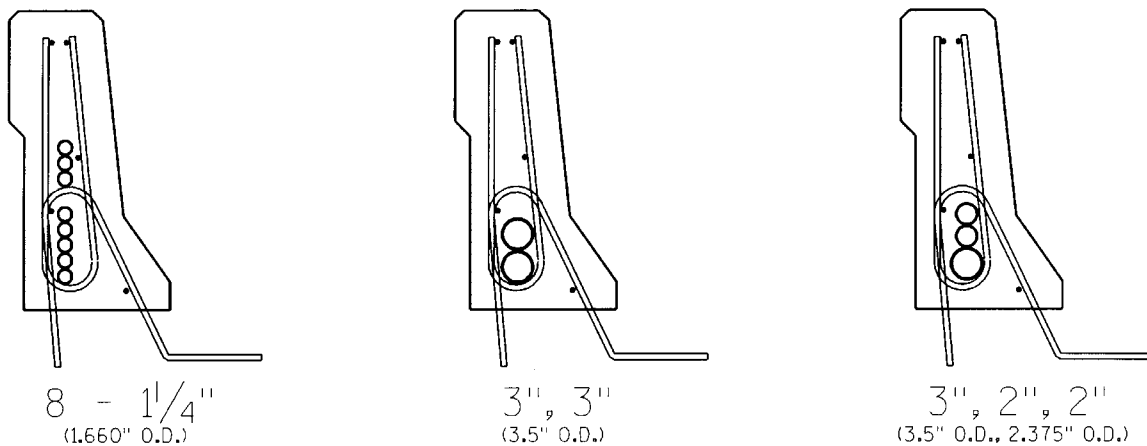
Sidewalks - If there is a parapet between the roadway and a sidewalk and the roadway side of the parapet is more than 11'-0" from the exterior edge of deck, the sidewalk width must be 10'-0" clear between barriers. Access must be provided to the sidewalk for the "snooper truck" to inspect the underside of the bridge. The boom extension on most trucks does not exceed 11'-0" so provision must be made to get the truck closer to the edge.

30.4 PLAN NOTES & UTILITIES

The following applicable notes are placed on the plans:

- (1) Rails shall be built straight and sprung into place. (Used only on plans for structures requiring up to 3° of rail curvature.)
- (2) Rails shall be curved to fit the structure. (Used only on plans for structures requiring greater than 3° of rail curvature.)

The maximum allowable conduits that can be placed in HF or LF parapets are shown in the following sketches (LF only shown). Junction (Pull) boxes can only be used with 2" diameter conduit. The maximum length of 3" conduit is 190', as no boxes are allowed.



When light poles are mounted on top of parapets and the design speed exceeds 45 mph the light pole must be located behind the back edge of the parapet. The poles should, also be placed over the piers unless there is an expansion joint. Place 4 feet away if this is the case. The poles must also be located to avoid falling on travel lanes below the bridge in case of vehicle impact on the pole.

FDM 9-25-5 addresses whether a bench mark disk should be set on a structure. Structures are not usually preferred due to possible elevation changes from various causes. DOT has discontinued the statewide practice of furnishing a disk and requiring it to be placed on a structure.

30.5 PROTECTIVE SCREENING

Protective screening is a special type fence constructed on the sides of an overpass to discourage and/or prevent people from dropping or throwing objects onto vehicles passing underneath the structure. Protective screening is generally chainlink type fencing attached to steel posts mounted on top of a vertical parapet or on a sidewalk surface. The top of the protective screening may be curved inward toward the structure to prevent objects from being thrown off the overpass structure. Aesthetics is enhanced by using a colored protective screening which can be coordinated with the color of the structure. See Chapter 37.3 for screening details.

Examples of situations that warrant consideration of protective screening are:

1. If there is a history of or instances of objects being dropped or thrown from an existing overpass.
2. For all new overpasses if there have been instances at other existing overpasses in the area.
3. On overpasses near a school, playground, residential area or any other location where the overpass may be used by children who are not accompanied by an adult.

In addition, all pedestrian overpasses should have protective screening on both sides.

1. When protective screening is warranted, the minimum design should require screening on the side of the structure with sidewalk. Designers can call for protective screening on sides without sidewalks if those sides are readily accessible to pedestrians.
2. Designers should insure that where protective screening is called for, it does not interfere with sight distances between the overpass and any ramps connecting it with the road below. This is especially important on cloverleaf and partial cloverleaf type interchanges.
3. Protective screening is not always warranted. An example of when it may not be warranted is on an overpass without sidewalks where pedestrians do not have safe or convenient access to either side because of high traffic volumes and/or the number of traffic lanes that must be crossed.

| Occasionally access to light poles behind protective screening is required or the
| screening may need repair. To gain access attach fence stretchers to the fencing and
| remove one vertical wire by threading or cutting. The vertical wire may be cut without
| using fence stretchers. To repair attach fence stretchers and thread a vertical wire in
| place of the one removed by either reusing the one in place or using a new one.

| Fence repair would follow this same process except the damaged fencing would be
| removed and replaced with new fencing.

30.6 MEDIANS

Refer to Facilities Development Manual S.D.D. 8D1-13 for median details. The preferred median for structures is shown in the following figure.

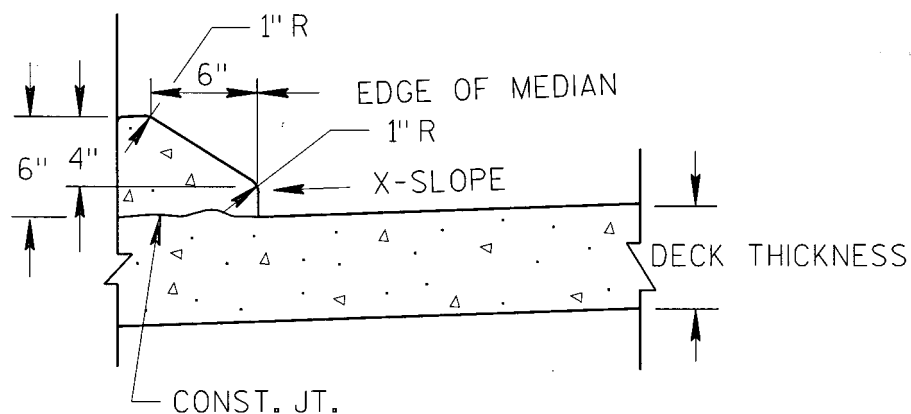


FIGURE 30.6-1 MEDIAN FOR STRUCTURES